IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	10/698,920
Applicant(s)	:	Daniel C. Conrad, et al.
Filed	:	October 31, 2003
T.C./A.U.	:	1751
Examiner	:	Amina S. Khan
Docket No.	:	US19984054-8 (31480.3)

I hereby certify that this correspondence is being mailed to the U. S. Patent and Trademark Office, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date indicated below.

Name : Eileen T. Mathews

Signature: _____

Date : March 11, 2008

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Declaration Under 37 § C.F.R. 1.131

Dear Sir:

I, one of the inventors, hereby declare as follows:

1. I am a named co-inventor of the subject matter that is claimed and for which a patent is sought on the invention as above mentioned. This U.S. Application Serial No. 10/698,920 was filed on October 31, 2003. This application is a continuation-in-part of U.S. Application Serial No. 10/027,160 which was filed on December 20, 2001, and U.S. Application Serial No. 10/027,431 filed on December 20, 1998, which claim the benefit of the earlier filing date of provisional patent application 60/045,072 filed on April 29, 1997. I have reviewed the subject matter of provisional application 60/045,072 and can attest that the subject matter of the Applicants' independent claims are supported by the Application. As such, the pending Application Serial No. 10/698,920 has an earliest effective filing date of April 29, 1997.

2. In the Office Action dated September 11, 2007 the United States Patent and Trademark Office (USPTO) rejected claims 1-13, and 24-37 under section 103(a) as being unpatentable over by Flynn et al., US Patent No. 5,962,390, filed on May 17, 1996 and issued on October 5, 1999, which is a continuation-in-part of application serial no. 08/573,416 filed on December 15, 1995, and which claims the benefit of application no. 08/375,812, filed on January 20, 1995, now abandoned, (hereinafter "Flynn et al."), and in view of each of the secondary

references, Dickey, et al. (US 3,410,118), De Pas et al. (US 3,163,028), Tatch et al. (US 5,431,827) and Krugmann (US 4,252,546).

3. Claims 1-13, and 24-37 of Application Serial No. 10/698,920 which have a priority date of April 29, 1997 are not obvious over Flynn et al., in view of the secondary references.

4. Per applicable U.S. patent law, Flynn et al. 5,962,390 has an effective 102(e) date of May 17, 1996 (the filing date).

5. This written document is a declaration of prior invention to antedate the cited reference of Flynn et al. 5,962,390. I, an Inventor of the subject matter of the rejected claims, hereby submit this declaration to overcome this reference. I performed certain acts described below.

I. Showing of Facts Through Document Evidence

6. Below are facts that show a conception of the invention on or before the May 17, 1996 filing date of Flynn et al. 5,962,390 coupled with due diligence from such conception to a subsequent actual reduction to practice or to the provisional application filing date of 29 April 1997.

7. Exhibit A and Exhibit B were previously submitted in an Affidavit which I executed on January 2, 2007 and was filed on March 2, 2007 along with a Response to Office Action dated November 2, 2005. Exhibits C, D, E, F, and G are submitted herewith and were created to summarize a brainstorming session prior to May 17, 1996. Exhibit H is evidence of the Exhibits stored in the "Whirlpool Information Network" showing the dates these documents were inputted into the network. Exhibit I is also submitted herewith and is a report dated August 15, 1996 of a laboratory study for research which was initiated prior to May 17, 1996.

8. Exhibit H shows the digitized records saved on the Whirlpool Information Network. The information is controlled digitized evidence which is password protected for read-only access. The "Date Composed" is the dates the specific documents were saved in the network following the brainstorming session. Exhibit H shows that the dates Exhibits C, D, E, F and G were saved to the network were on March 1, 1996, March 7, 1996 and May 6, 1996 and prior to May 17, 1996.

9. Exhibit I is a Report 517720-005 entitled "Detersive Properties of Hydrocarbons, Fluorocarbons and Microemulsions" of a study which determined the detersive properties of various compounds such as alcohols, carboxylic acids, esters, fluorocarbons, ketones, and terpenes. The report of Exhibit I discusses the background concerns of dry cleaning compounds that were traditionally used as well as the test set-up, fabric washing methods and results.

Several fabric types were laundered in a simulated washing machine, a tergotometer and tested for reactivity with the various fabrics.

A. Facts establishing conception

10. In general, the facts of Exhibits C, D, E, F, G, H and I are hereby incorporated by reference. Moreover, I present the following facts to establish a conception of the invention before the May 17, 1996 Flynn et al. filing date.

(i) Conception

11. The basic inventive concept of the application is the fluid composition used in non-aqueous laundering.

12. The USPTO presents Flynn et al. as teaching a variety of solvents suitable for dry cleaning applications which also meets the properties required of Applicants' working fluid. However, as explained in the contemporaneously filed Response to non-final Office Action dated March 11, 2008, Flynn et al. do not disclose a wash liquor for laundering a fabric load in an automatic laundering apparatus. Flynn et al. is directed to cleaning substrates, primarily metal and does not teach wash liquor compositions for cleaning fabric loads. Flynn et al. do not disclose a bulk fluid that is inert and having the properties as claimed for use in an automatic laundering apparatus.

13. The details of previously submitted Exhibit A and contemporaneously submitted Exhibits C, D, E, F, G and H support conception of the claimed invention and show "Project Hope" encompasses non-aqueous working fluid chemistries. Thus, the scope of this declaration is commensurate with the scope of the claimed subject matter.

14. Particularly, Exhibit C shows the Domain of Fabric Laundering through discussion ideas concerning bulk fluid "Chemistry", "Machine Characteristics and Structure" and "Cycles/Processes". The Venn Diagram shows that Project Hope was concerned with researching non-reactive, inert bulk fluids which included fluoroinerts, FI, and yet possessed properties were outside the domain or "space" of the traditional bulk fluids, namely, water, perc, and carbon dioxide which were "reactive" bulk cleaning fluids possessing relatively high Kauri-Butanol values for cleaning ability. We conceived a wash liquor for cleaning a load of fabric in an automatic laundering apparatus, for example a home laundering unit, and that such cleaning can be accomplished through mechanical cleaning where the "bulk" of the wash liquor is inert and substantially less portion of the wash liquor is additives. We conceived and determined that it would not be required that bulk dry-cleaning fluids of the wash liquor possess the reactive properties of chemicals know to be used in dry cleaning at that time. Fluoroinerts have a Kauri-Butanol value less than 30 and are relatively non-reactive to known bulk fluids of dry-cleaning wash liquors. The perc compounds replaced earlier low flash point hydrocarbons for non-aqueous dry-cleaning and this is well documented in dry-cleaning literature. Although some of the hydrocarbon compounds were considered "non-reactive" and having relatively low KB

values, these "oleophilic" compounds which were already replaced by perc we conceived of "non-oleophilic" compounds. Therefore the desired "non-aqueous", "apolar" bulk dry-cleaning fluids were to be inert or "non-reactive" to several fabrics and also compatible with additives such as oxygen bleach, detergents which include fragrance, co-solvents, enzymes, etc. Such bulk fluid chemistries were considered in conjunction with in-home washing machine equipment and various wash cycles and processes as indicated by the topic headings of Exhibit C and which were discussed in the brainstorming session of Project Hope.

15. Exhibit D lists the characteristics of fluoroinerts which were relevant in developing testing protocol.

16. Exhibit E lists the potential property characteristics (i.e. "FuFu") of the desired "non-aqueous", "non-reactive", "non-oleophilic" and "apolar" working fluids for use in a laundering method in an automatic laundering apparatus. Exhibit F shows that the desired inert working fluid is defined as "does no cleaning" and "fabric stability" which was outside the scope of the known compounds for wash liquors which cleaned fabric loads at the time.

17. The previously filed Exhibits A and B pertaining to Project Hope also illustrates desired characteristics of the inert working fluid chemistries and the various characteristics of an exemplary non-aqueous working fluid and that hundreds of compounds were selected for further testing and that several were currently being bench tested. Exhibit B listed some of the testing protocols.

18. Exhibit G is a table of several compounds which were evaluated. Exhibit H shows the document of Exhibit G is entitled "Updated Non-Aqueous Matrix" which was composed (i.e. entered into the network) on May 6, 1996.

(ii) Effective date of Flynn et al.

19. As indicated on the face of the Flynn et al. patent, issued on October 5, 1999, and has a section 102(e) date (filing date) of May 17, 1996. Accordingly, the date to overcome is May 17, 1996.

(iii) On or before the effective date of Flynn et al.

20. I allege that the acts relied upon to establish the date on or before May 17, 1996. The testing and the exhibits attached were generated prior to the effective date of Flynn et al.

B. <u>Facts establishing reduction to practice</u>

21. In general, the facts of Exhibits C, D, E, F and G are hereby incorporated by reference. Moreover, I present the following facts to establish a reduction to practice.

(i) **Actual reduction to practice**

22. After conception of the invention on or before May 17, 1996, I tested or had the invention tested to establish its capacity to successfully perform its intended purpose. Previously filed Exhibit B represents an invention testing protocol/assessment that discusses the experiments that would be run during a period starting before May 17, 1996 and into later parts of 1996. Contemporaneously submitted Exhibit I explain the background, testing methods and results of several non-aqueous inert fluids which could be used for laundering fabrics in an automatic laundering apparatus.

23. Previously filed Exhibit A and contemporaneously filed Exhibits C, D, E, F, G and H show information generated and dated prior to May 17, 1996 that show the many chemicals that were currently used in the industry and which were not subject of the desired compounds of the invention, and also, that of the many chemicals that exhibited some of the desired characteristics, several were chosen as candidates. Several candidates were benchtop tested.

(ii) **Constructive reduction to practice**

24. I allege that the present application for a U.S. patent recites independent claims of the same invention disclosed in the provisional application filed or April 29, 1997.

25. Therefore, constructive reduction to practice was achieved on April 29, 1997.

C. **Facts establishing reasonable diligence**

26. I present the following facts to establish that there was reasonable diligence from before the May 17, 1996 effective date of Flynn et al. to the actual reduction to practice of the invention or alternatively to the provisional filing date.

27. As noted above, conception occurred on or before the May 17, 1996 filing date of Flynn et al. Moreover, actual reduction to practice occurred on or before April 29, 1997. I assert that there was reasonable diligence from conception to reduction to practice, either actual or constructive. Exhibits C, D, E, F and G indicate that several inert working fluids were outside the scope of known reactive dry-cleaning fluids, and that such inert non-aqueous, non-reactive, non-oleophilic, and apolar working fluids were selected as having desirable characteristics and these chemicals were submitted for further bench testing. The characteristics were counter-intuitive of the characteristics of known dry-cleaning wash liquors used on fabric loads in an automated laundering apparatus. As Exhibits C, D, E, F, G, H and I show, I was cognizant of the need to pursue patent applications to protect the invention. The inventors timely filed a provisional patent application on April 29, 1997. The selection of chemicals, the experiments, conducted throughout 1996 and the actual filing of a patent application indicate a reasonable diligence period from on or before the Flynn et al. filing date.

28. Alternatively, the time period taken for the completion of the application constitutes reasonable diligence. During this time period, I and/or our representative worked reasonably hard and expeditiously to prepare, execute and file a patent application in the United States Patent Office. Accordingly, there was reasonable diligence from on or before the Flynn et al. filing date to the filing of the application of the present invention.

II. Allegations and other Statements

29. I allege that the acts relied upon to establish the date on or before Flynn et al. were carried out in the United States.

III. Signature and Declaration in Lieu of Oath Under 37 CFR 1.68

30. I hereby declare that the statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I acknowledge that willful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or patent issuing thereon.

Tremitchell Wright

3/11/08
Date

EXHIBIT C

Chemistry
Alternative to FI
Additives
- Oxygen bleach
- Detergents (non-traditional surfactants)
- Enzymes
- Brighteners
- Co-solvents
- 2 Phase cleaning
  Solutions -
  Cq FI and C0
  FI and H_20

Machine Characteristics, Structures
- Recovery
- Ventilation
- Containment
- Mechanical Input
- Dispensing
- Thermal Input
- Geometry of Fabric (hanging, batch vs. continuous drying in bag
- Footprint

Cycles/Process
- Water followed by FI
- Mist
- Emulsion Wash
- Dry Cycle

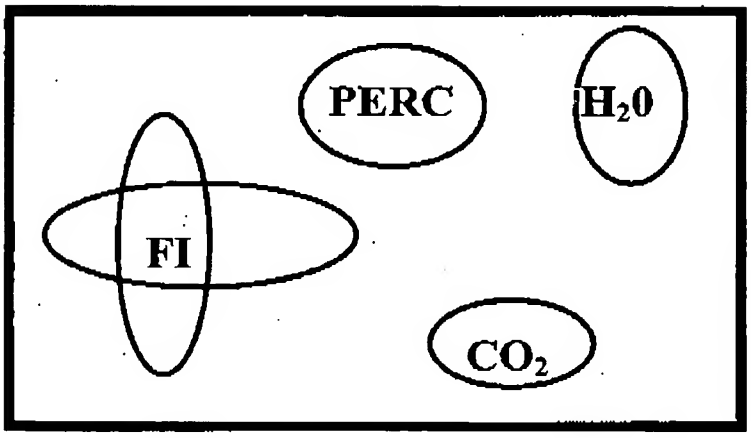

EXHIBIT D

Characteristics

KNOWN	UNKNOWN
FI not available at commercial prices	Fiber damage unknown
Displacement of H_20	Dye transfer unknown -
Low vapor pressure - need to avoid leaks	Quality of "grade" needed unknown
Osmotic gradients	Variability of molecule size effects drying rate, surface tension rate, surface tension
Low viscosity speeds penetration of fabric	Dielectric characteristics might reduce static or also allow control charge density of contaminants or can the charge surfactants
Broad range of FI's available	Unknown FI reactivity with additives
Cavitation in pumps	Solvency of particular soils unknown
FI is considered environmentally safe, non-toxic	FI non-polar might limit shrinkage of wool
pH neutral	Sanitization effect unknown
FI's have a wide range of vapor pressures - allows flexibility of heating characteristics	
FI absorbs oxygen so may facilitate oxy bleaches.	
Sensors for leaks exists.	
FI is easily recyclable and disposable (except reactivity unknown)	

EXHIBIT E

Potential FuFu Charectoristics

- Low surface tension less than 1/2 of H_20 with detergent (15 dynes /cm^2) at STP (or at operating condition)
- Viscosity < H_20 [1 N/M]
- Minimum solubility in water (<10%)
- Density different by more than ±10% from H_20 (at operating condition)
- pH Neutral [6.5 - 7.5]
- Non-reactive with bleach? (Highly non-reactive)
- Minimal solvency of oil soil
- Carries enzymes and bleach without restricting their activity (redox potential >y) (enzyme 1/2 life >y)
- low vapor pressure> 7 1/2 at m.

Project HOPE

Meeting Notes for Non Aqueous Development Needs

- For inital patent work go with FI technology
- Make a mixture .... (Solution will be multi-component
- Decision Matrix for Evaluation
  - Define IWF
  - Co-Solvent or Detergent for IWF
- We define inert as:
  - Does no cleaning
  - Fabric Stability
- The greatest Area of Concern/Potential is the recovry/rinse,separation,disposal.
  - ex. Rynex is misible with H2O so old gravity PERC cleaner is not usable!

EXHIBIT G

CLASSIFICATION	COMPOUND	INDUSTRIAL USE	WATER SOLUBILITIES (GR / 100 GR WATER)	TOXICOLOGY / HAZARDS	SURFACE TENSION	VAPOR PRESSURE (mm)	VAPOR DENSITY	SOLVENCY	REACTIVITY	VISCOSITY	BOILING POINT (C)	DENSITY @ 20 C	FLASH-POINT (C)
ALCOHOLS	1,1,1,3,3,3-HEXAFLUORO-2-PROPANOL								REACTIVE		59.0	1.596	NONE
	1,6-HEPTADIEN-4-OL			COMBUSTIBLE					OXIDIZERS		151.0	0.864	39
	1-CYCLOHEXYLETHANOL								OXIDIZERS		169.0	0.928	72
	1-OCTADECANOL	Emulsions, Antifoams	INSOL	IRRITANT		<0.01	9.3		OXID \ ACIDS		170.0		NONE
	1-OCTANOL	Perfumes	INSOL	COMB \ HARM		0.14	4.5		ACIDS\OXID		195.0	0.827	81
	1-TETRADECANOL	WETTING AGENT IN TEXTILE	INSOL	IRRITANT			7.4		OXID\ACIDS		289.0	0.823	109
	1-UNDECANOL			IRRITANT					OXID \ ACID		146.0	0.830	109
	2,3-DIMETHYL-2-BUTANOL		2.44	IRRITANT					ACIDS \ OXID		121.0	0.823	29
	2,4,4-TRIMETHYL-1-PROPANOL		3.50	COMBUSTIBLE		0.18	4.9		OXID\ACIDS		168.0	0.818	53
	2,4-DIMETHYL - 2,4-PENTANEDIOL			NA					OXIDIZERS		98.0	0.920	96
	2,6-DIMETHYL -4- HEPTANOL			COMBUSTIBLE					OXIDIZERS		178.0	0.809	66
	2,6-DIMETHYLCYCLOHEXANOL								REACTIVE		175.0	0.944	54
	2-BUTENE-1,4-DIOL		6.00	IRRITANT					REACTIVE		131.6	1.070	109
	2-DECANOL	SOLVENTS \ SURFACTANTS	INSOL	IRRITANT					ACIDS \ OXID		211.0	0.827	84
	2-ETHOXYPHENOL	WETTING AGENT \ ANTI STA	V. SOL	IRR \ COMB					OXID \ BASES		218.0	1.090	91
	2-ETHYL-1-HEXANOL	SOLVENT FOR DYES	72.00	IRR \ HARM		0.2	4.49		OXID \ ACIDS		183.0	0.833	77
	2-METHYL-1-BUTANOL	OILS	3.60	COMB \ HARM		3	3		OXIDIZERS		130.0	0.815	43
	2-METHYL-2-HEXANOL	SOAPS	0.10	COMBUSTIBLE				FATS	CID\OXID\RED		141.0	0.812	40
	2-METHYL-3-HEXANOL			COMBUSTIBLE					OXIDIZERS		141.0	0.821	40
	2-METHYL-3-PENTANOL			COMBUSTIBLE					ACIDS\OXID		128.0	0.819	46
	2-METHYLCYCLOPENTANOL			COMBUSTIBLE					ACID\RED\OXID		150.0	0.920	47
	2-METHYLPHENETHYL ALCOHOL	OILS	INSOL	NA					ACID\OXID\RED		243.0	1.016	109
	2-NONANOL	OILS	INSOL	COMBUSTIBLE					OXIDIZERS		193.0	0.827	82
	2-OCTANOL	DISINFECTING SOAPS	0.10	IRR\COMB				FATS \ WAXE	OXIDIZERS		174.0	0.819	71
	3,4-DIMETHYLCYCLOHEXANOL								OXID \ ACIDS		189.0	0.949	78
	3,5,5-TRIMETHYL-1-HEXANOL			COMBUSTIBLE					OXIDIZERS		193.0	0.824	79
	3,7 - DIMETHYL -1- OCTANOL			IRRITANT		<0.01	5.4		OXIDIZERS		95.0	0.840	94
	3-CYCLOHEXYL -1-PROPANOL								OXIDIZERS		216.0	0.937	101
	3-CYCLOPENTYL-1-PROPANOL								OXID \ ACIDS		95.0	0.907	82
	3-ETHYL -3-PENTANOL			COMBUSTIBLE					ACIDS \ OXID		141.0	0.824	39
	3-HEXEN-1-OL			COMBUSTIBLE					OXID \ ACIDS		61.0	0.817	58
	3-METHYL-1-PENTANOL			IRR\COMB		>1	>1		OXID \ ACIDS		151.0	0.823	59
	3-METHYL-2-BUTENE-1-OL			COMB \ IRR		1.4	>1.0		OXIDIZERS		140.0	0.848	43
	3-METHYL-2-PENTANOL			COMBUSTIBLE					OXIDIZERS		131.0	0.831	40
	3-METHYL-3-PENTANOL	PHARMACEUTICALS	4.00	COMB \ HARM					[illegible]		[illegible]	[illegible]	[illegible]
	3-NONEN-1-OL			COMBUSTIBLE					OXID \ ACIDS		107.0	0.843	62
	3-OCTANOL			IRR\COMB		1	4.5		OXIDIZERS		174.0	0.819	66
	3-PENTANOL	SOLVENTS	5.50	COMB\HARM					OXIDIZERS		114.0	0.815	40
	4-CYCLOHEXYL - 1 - BUTANOL								OXID \ ACIDS		104.0	0.902	108
	4-HEXEN-1-OL			COMBUSTIBLE					OXID \ ACIDS		159.0	0.851	61
	4-METHYL-1-PENTANOL			COMBUSTIBLE		3.7	3.5		ACID \ OXID		160.0	0.821	51
	4-METHYL-2-PENTANOL			COMB \ IRR		3.7	3.5		ACID \ OXID		132.0	0.802	41
	4-METHYL-3-HEPTANOL			COMB \ IRR					OXID\ACID		98.0	0.827	54
	4-METHYL-3-PENTEN-1-OL			COMBUSTIBLE					OXID \ ACIDS		157.0	0.858	63
	4-METHYLPHENETHYL ALCOHOL			NA					ACID\OXID\RED		244.0	0.978	107
	5-HEXEN-1-OL			COMBUSTIBLE					OXIDIZERS		78.0	0.834	47
	6-METHYL-2-HEXANOL			COMBUSTIBLE					ACID\OXID\RED		148.0	0.819	46
	6-METHYL-2-HEPTANOL			COMBUSTIBLE					OXID \ ACIDS		171.0	0.803	67
	6-METHYL-5-HEPEN-2-OL			COMBUSTIBLE					OXID \ ACIDS		78.0	0.844	67
	CYCLOBUTANOL								OXID \ ACIDS		123.0	0.921	21
	CYCLOBUTANOL								OXID \ ACIDS		123.0	0.921	21
	CYCLOHEPTANEMETHANOL								OXID \ ACIDS		213.0	0.932	92
	CYCLOHEPTANOL								[illegible]		[illegible]	[illegible]	[illegible]
	CYCLOOCTANOL								OXID \ ACIDS		108.0	0.876	86

PROPERTIES

CLASSIFICATION	COMPOUND	INDUSTRIAL USE	WATER SOLUBILITIES (GR / 100 GR WATER)	TOXICOLOGY / HAZARDS	SURFACE TENSION	VAPOR PRESSURE (mm)	VAPOR DENSITY	SOLVENCY	REACTIVITY	VISCOSITY	BOILING POINT (C)	DENSITY @ 20 C	FLASH-POINT (C)
	Iso-PENTYL	MFG ARTFICIAL SILK	2.00	NARCOTIC			FATS / RESINS				132.0	0.813	45
	ISOBUTYL	MFG FRUIT FLAVORS	10.00			8	2.55	INT / VARNI	OXID \ ACID		108.0	0.802	20
METHYL-3-TRIFLUOROMETHYL BENZYL ALCOHOL				NA					OXIDIZERS		100.0	1.249	98
	n-BUTYL	MFG OF DETERGENTS	7.90	IRRITANT		4	2.55	FATSIWAXE	REACTIVE		118.0	0.810	36
	n-HEPTYL	PERFUMES	0.20			0.5		FATS			176.0	0.822	79
	n-HEXYL	MFG OF ANTISEPTICS	0.60			1	4.5		OXID \ ACID		156.5	0.819	60
	n-OCTYL	PERFUMES	0.05			0.14	4.5	ATS \ WAXE	OXID \ ACID		195.0	0.825	60
	n-PENTYL	SOLVENT	2.30	RESPIRATORY			3				138.0	0.817	40
	NONOXYNOL	WETTING AGENTS	11.30							175	281.0	0.997	105
	sec-BUTYL	YNTH OF WETTING AGENT	12.50			12.5	2.6		ACIDS		99.5	0.806	31
	TERPINEN-4-OL	DENATURE FATS FOR SOAP	INSOL	HARM/COMB					OXIDVACID		88.0	0.933	79
	tert-PENTYL		12.50			12	3		OXIDIZERS		102.0	0.809	21
ALDEHYDES	2,4-NONADIENAL			COMBUSTIBLE			>1.0		OXIDIRED\BASE		97.0	0.882	85
	2-ETHYLHEXANAL			COMBUST \ IRR					OXID \ BASE		55.0	0.822	42
	2-METHYLUNDECANAL			NA					OXIDIACID\BASE		171.0	0.830	93
	2-NONENAL	FLAVORING AGENT		COMB \ IRR			>1		STABLE		86.0	0.846	84
	2-PHENYLPROPIONALDEHYDE												
	3-METHYL-2-BUTENAL	FLAVORS \ PERFUMES	10.00	IRRITANT		7	>1		OXID \ RED		94.0	1.002	76
	BENZALDEHYDE	MFG OF DYES	0.30	IRRITANT		4MM	3.7		OXID \ BASE		133.0	0.872	33
	CAPROALDEHYDE	POLIMERIZATION	0.05	IRRITANT					STABLE		178.0	1.042	62
	CYCLOOCTANECARBOXALDEHYDE										131.0	0.814	
	HEPTALDEHYDE	SYNTHESIS OF CMPDS	0.10	FLAM \ IRR	25.68						96.0	0.940	67
	ISOBUTYLALDEHYDE	SYNTHESIS OF CELLULOSE	11.00	IRRITANT		66	2.5	FATS	KID \ BASE\RA	0.977	155.0	0.818	34
	METHONE	EPARATION OF ALDEHYDE	0.42	COMBUSTIBLE		0.5	>1.0		OXID \ RED		63.0	0.784	-16
	n-BUTYRALDEHYDE	MFG RESINS	7.00	IRRITANT		90	2.5		OXID \ RED		207.0	0.893	72
	n-VALERALDEHYDE	FLAVORING CMPD	0.05	MILD					OXID \ RED		76.0	0.801	-7
	NONYL ALDEHYDE			IRR \ COMB		0.26	>1		OXIDIRED\BASE		103.0	0.810	12
	PHENYLACETALDEHYDE	SYNTHESIS OF CMPDS	0.05								93.0	0.827	63
	PROPIONALDEHYDE		16.00	TOXIC		4.89 psi	2		OXIDIZER		184.0	1.027	200
	TETRADECYL ALDEHYDE			IRRITANT					OXIDIZER		49.0	0.806	-6
	TRIDECANAL			IRRITANT					OXIDIBASE\AIR		166.0	0.902	109
ALICYCLICS	1,1-DIMETHYLCYCLOHEXANE										132.0	0.835	109
	1,2-DIMETHYLCYCLOHEXANE					42	2.4		OXIDIZERS		120.0	0.777	7
	BUTYLCYCLOHEXANE								OXIDIZERS		124.0	0.778	15
	CYCLODECANE										[illegible]	0.856	41
	CYCLOOCTENE								OXIDIZERS		201.0	0.871	84
	CYCLOHEPTANE	LACQUERS / RESINS	INSOL	SKIN		44	2.2	OILS	OXIDIZERS		245.0	0.883	93
	CYCLOHEXANE	PAINT REMOVERS	INSOL	SKIN		77	2.9	OILS	OXIDIZERS		118.0	0.810	5
	CYCLOPENTANE	MFG RESINS	INSOL			5.12 PSI	2.1		OXIDIZERS		81.0	0.778	-18
	CYCLOPENTENE					6.11 PSI			OXIDIZERS		46.0	0.744	-10
	METHYLCYCLOHEXANE	ALKYLATION CMPD	INSOL			37	3.4		OXIDIZERS		100.0	0.769	-1
	METHYLCYCLOPENTANE	PERFUMES	INSOL			232.8	4.9		OXIDIZERS		72.0	0.749	-11
ALKANES	2,2,4,4,6,8,8-HEPTAMETHYLNONANE			NA		<1.0	7.9		OXIDIZERS		240.0	0.793	96
	CYCLOOCTANE					15	>1		OXIDIZERS		151.0	0.834	29
	DECANE			IRRITANT		3.77	4.9		OXIDIZERS		174.0	0.730	46
	DOCOSANE			IRRITANT		<1	10.8				369.0	0.778	110
	DODECANE			COMBUSTIBLE		1	5.95		OXIDIZERS		215.2	0.750	71
	ETHYLCYCLOPENTANE			FLAMMABLE		72.8	>1		OXIDIZERS		103.0	0.769	15
	HEPTADECANE			NA		1	8.3		OXIDIZERS		302.0	0.777	148
	HEPTANE	FUELS	INSOL	IRRITANT		40	3.5		OXIDIZERS		[illegible]	[illegible]	[illegible]
	[illegible]	SYNTHESIS	INSOL	IRRITANT		132	3		OXIDIZERS		69.0	0.659	-12

PROPERTIES

CLASSIFICATION	COMPOUND	INDUSTRIAL USE	WATER SOLUBILITIES (GR / 100 GR WATER)	TOXICOLOGY / HAZARDS	SURFACE TENSION	VAPOR PRESSURE (mm)	VAPOR DENSITY	SOLVENCY	REACTIVITY	VISCOSITY	BOILING POINT (C)	DENSITY @ 20 C	FLASH-POINT (C)
	ISOHEXANE			FLAMMABLE		120	3		OXIDIZERS		60.0	0.654	-12
	ISOPENTANE	THINNERS	INSOL	IRRITANT		184	2.6		STABLE		28.0	0.620	21
	METHYLPENTANE			FLAMMABLE		160	3		OXIDIZERS		63.0	0.670	-12
	NEOPENTANE		INSOL	IRRITANT		41	1		OXIDIZERS		80.0	0.693	-6
	NONADECANE			NA		1	9.27		OXIDIZERS		330.0	0.765	166
	NONANE			INSOL		10	4.41		OXIDIZERS		151.0	0.718	31
	OCTADECANE	EMULSIONS, TEXTILE OIL	INSOL	IRRITANT		1	8.8		OXIDIZERS		317.0	0.777	155
	OCTANE	FUELS	INSOL	IRRITANT		51	3.9		OXIDIZERS		126.0	0.703	15
	PENTANE	FUELS, SYNTHESIS	0.36	IRRITANT		11	5		OXIDIZERS		36.0	0.626	13
	TETRADECANE	WETTING AGENT	INSOL	IRRITANT		<100	6.83		OXIDIZERS		252.0	0.763	99
	TRIDECANE			IRRITANT		1	6.4		OXIDIZERS		234.0	0.750	79
	UNDECANE			IRR \ COMB		<0.4	5.4		BASE\OXIDIZED		195.0	0.740	60
ALKENES	1-DECENE			COMB \ IRR					OXIDIZERS		171.0	0.743	
	1-HEPTADECENE			NA					OXIDIZERS		157.0	0.785	109
	1-HEPTENE			IRRITANT		101	3.1		OXIDIZERS		93.0	0.698	-7
	1-HEXADECENE			NA		<0.2	>0.8		OXIDIZERS		274.0	0.783	132
	1-HEXENE			FLAMM \ IRR		155	3		OXIDIZERS		63.5	0.675	-7
	1-NONENE			COMBUSTIBLE		11	4.35		OXIDIZERS		146.0	0.730	45
	1-OCTADECENE			NA			0.71		OXIDIZERS		179.0	0.789	149
	1-OCTENE			FLAMM\HARM		36	3.9		ACID/OXID		123.5	0.716	21
	1-PENTADECENE			NA					OXIDIZERS		268.0	0.775	109
	1-PENTENE			FLAMM \ IRR		151	2.4		OXIDIZERS		30.0	0.643	-6
	1-TETRADECENE			IRRITANT			6.8		OXIDIZERS		251.0	0.775	115
	1-TRIDECENE			COMBUSTIBLE					OXIDIZERS		232.0	0.766	79
	1-UNDECENE			HARM \ COMB					OXIDIZERS		192.0	0.750	62
	2,3-DIMETHYL-2-BUTENE										73.0	0.705	
	2-BENZOYL - 5- NORBORNENE								OXIDIZERS		124.0	1.115	100
	2-METHYL-1-UNDECENE			COMBUSTIBLE					OXIDIZERS		207.0	0.767	72
	2-METHYL-2-BUTENE			FLAMM \ IRR		65	2.4		OXIDIZERS		38.0	0.660	0
	2-NONENE			FLAMMABLE					OXIDIZERS		144.0	0.734	32
	2-PENTENE			FLAMMABLE		11.6	3		OXIDIZERS		37.0	0.655	0
	3-NONENE			FLAMMABLE					OXIDIZERS		143.0	0.734	32
	4-NONENE			FLAMMABLE					OXIDIZERS		144.0	0.732	27
	7-TETRADECENE			NA					OXIDIZERS		250.0	0.764	99
	A-TERPINENE			COMB \ HARM		0.7	4.6						
	CYCLOOCTENE								OXIDIZERS		146.0	0.848	24
	G-TERPINENE			COMB \ IRR		0.7	4.7		OXIDIZERS		182.0	0.849	61
	KEROSENE			HARMFUL		0.23	4.5		OXID\ACID\BASE		175.0	0.800	61
ALKYNES	1-DODECYNE								OXIDIZERS		215.0	0.778	79
AMIDES	DIETHYLPROPIONAMIDE			INHALANT									
	DIMETHYLPROPIONAMIDE			IRRITANT					OXID \ ACIDS		77.0	0.897	72
	PROPIONAMIDE	ESTERIFYING AGENT	SOL	IRRITANT					OXID \ BASES		174.0	0.920	62
	STEARAMIDE												
AMINES	ACETONITRILE	EXTRACT FATTY ACIDS	SOL	POISON	29.04	72.8 MM	1.41		REACTIVE		82.0	0.788	5
	1,3-CYCLOHEXANEBIS(METHYLAMINE)								OXIDIZERS		200.0	0.945	106
	CYCLOBUTYLAMINE								ACIDS		81.5	0.833	-4
	2-FLUOROPHENETHYLAMINE								OXIDIZERS		64.0	1.060	77
CARBOXYLIC AC	DIETHYL DODECANEDIOATE								OXIDIZERS		193.0	0.951	109
	DIETHYL OXALPROPIONATE								ACIDS \ BASE \ OXID		138.0	109.00	1.073
	DIETHYL PROPYLMALONATE								ACID \ BASE \ OXID		222.0	0.887	91
	DIETHYL SEBACATE			IRRITANT					OXID \ BASE		312.0	0.963	109
	DIETHYL SUBERATE								ACID \ BASE \ OXID		282.0	0.962	109

PROPERTIES

CLASSIFICATION	COMPOUND	INDUSTRIAL USE	WATER SOLUBILITIES (GR / 100 GR WATER)	TOXICOLOGY / HAZARDS	SURFACE TENSION	VAPOR PRESSURE (mm)	VAPOR DENSITY	SOLVENCY	REACTIVITY	VISCOSITY	BOILING POINT (C)	DENSITY @ 20 C	FLASH-POINT (C)
	DIETHYL SUCCINATE		INSOL	IRRITANT			6		ACID \ BASE \ OXID		217.7	1.047	90
	DIMETHYL 3-HYDROXYGLUTARATE			NA					OXIDIZERS		139.0	1.192	109
	DIMETHYL 3-METHYLGLUTACONATE			NA					ACIDS \ BASE \ OXID		109.0	1.095	97
	DIMETHYL MALONATE			IRRITANT					ACIDS \ BASE \ OXID		180.0	1.156	89
	DIMETHYL METHYLSUCCINATE			COMBUSTIBLE					ACIDS \ BASE \ OXID		196.0	1.076	83
	ETHYL CAPRATE			IRRITANT					ACIDS \ BASE \ OXID		245.0	0.862	102
	ETHYL CAPRYLATE			IRR \ COMB		0.2	>1		ACIDS \ BASE \ OXID		206.0	0.878	74
	ETHYL PENTAFLUOROPROPIONATE			IRR \ FLAM					OXID \ BASES		75.0	1.299	1
	ETHYL UNDECYCLENATE			NA					OXID \ BASE		258.0	0.879	109
DIENES	1,13-TETRADECADIENE			HARM\IRR					OXIDIZERS		131.0	0.849	103
	1,3-CYCLOHEXADIENE					0.8	4.7		OXID/ACIDS		83.0	0.810	46
	1,3-CYCLOPENTADIENE					9.75	4.6		OXID/ACIDS		46.0	0.774	26
	1,4-CYCLOHEXADIENE					0.7	4.7		OXIDIZERS		80.5	0.840	51
	1,5-CYCLODECADIENE										69.0	0.879	74
	1,5-CYCLOOCTADIENE			IRRITANT		25.8	3.9		OXIDIZERS		150.0	0.882	31
	1,5-DIMETHYL-1,5-CYCLOOCTADDIENE								OXIDIZERS		74.0	0.897	55
	1,8-NONADIENE			IRRITANT		>1	>1		OXIDIZERS		141.0	0.740	26
	1,9-DECADIENE			IRRITANT					OXIDIZERS		169.0	0.750	41
ESTERS	METHYL HEPTAFLUOROBUTYRATE			IRRITANT			>1.0		OXID \ BASE		80.0	1.472	100
	4 DIBASIC ESTER			COMBUSTIBLE		0.3	7.2		ACID\BASE\OXID		200.0	1.117	84
	5 DIBASIC ESTER			NA		0.3	7.02		ACID\BASE\OXID		93.0	1.087	103
	DIETHYL ESTER			INHALANT		1	7.66		OXID \ ACID		299.0	1.118	159
	ETHYL CAPROATE			COMB \ IRR			5		OXIDIZERS		168.0	0.873	49
	ETHYL FORMATE			FLAMMABLE		56	2.5		OXID \ BASE		52.0	0.917	-16
	ETHYL UNDECANOATE			NA					OXIDIZERS		105.0	0.859	109
	METHYL -2-TRIMETHYLSILYL-2-HEPTANOATE			COMBUSTIBLE					OXIDIZERS		78.0	0.893	88
	METHYL 2-NONYNOATE			NA					OXIDIZERS		121.0	0.915	100
	METHYL CAPROATE			COMBUSTIBLE					OXID \ BASE		151.0	0.885	44
	METHYL CAPRYLATE			COMBUSTIBLE					ACID\OXIDIRED\BASE		194.0	0.877	72
	METHYL CYCLOHEXYLACETATE			COMBUSTIBLE					ACID \ BASE\OXIDRED		201.0	0.951	74
	METHYL DECANOATE			NA					OXIDIZERS		108.0	0.873	94
	METHYL NONANOATE			COMBUSTIBLE					OXID \ BASE		213.0	0.875	84
	METHYL PHENOXYACETATE			NA					OXIDIZERS		243.0	1.148	109
	METHYL TRIDECANOATE			NA					OXIDIZERS		131.0	0.864	109
	METHYL UNDECANOATE			NA					OXIDIZERS		134.0	0.872	100
ETHERS	[illegible]			[illegible]					OXIDIZERS		62.0	1.404	1
	2-HYDROXYETHYL ETHER			HARMFUL		0.01	2.14		OXID \ ACIDS		245.0	1.118	143
	ALLYL PHENYL ETHER								OXIDIZERS		182.0	0.978	62
	ANISOLE			COMBUSTIBLE		10	3.2		OXIDIZERS		154.0	0.995	51
	DI (ETHYLENE GLYCOL) DIETHYL ETHER			HARMFUL		0.5	6.6		OXID \ ACIDS		180.0	0.909	71
	ETHYL HEPTANOATE			IRRITANT					OXID \ BASE		188.0	0.868	66
	ETHYL PHENYL ETHER			COMBUSTIBLE					OXIDIZERS		170.0	0.966	57
	HEXAFLUORO DIETHYL ETHER	STIMULANT	INSOL								63.0	1.410	NONE
	HEXYL ETHER			IRR \ COMB					OXIDIZERS		229.0	0.793	78
	ISOPROPYL ETHER			FLAMMABLE		120	3.6		OXIDIZERS		68.0	0.726	-12
	PENTYL ETHER			COMBUSTIBLE					OXID \ ACIDS		187.0	0.786	57
	PROPYL ETHER												
FLUOROCARBON	1-FLUOROPENTANE			NA					OXIDIZERS		63.0	0.769	12
	2,2 - DIMETHYL - 6,6,7,7,8,8,8- HEPTAFLUORO-3,5-OCTANEDIONE			COMBUST \ FLAM					OXIDIZERS		47.0	1.273	38
	2,2,3,3,4,4,4-HEPTAFLUORO-1-BUTANOL			FLAM \ IRR					OXIDIZERS		96.0	1.600	24
	2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-PENTADECAFLUORO-1-OCTANOL			IRRITANT					OXIDIZERS		153.0	0.606	100
	2,2,3,3-TETRAFLUORCYCLOBUTANE CARBONITRILE			COMB\HARM					OXIDIZERS		148.0	1.391	54
	2,2,3,4,4,4-HEXAFLUORO -1-BUTANOL			COMB \ HARM					OXIDIZERS		114.0	1.557	51
	[illegible]			COMBUSTIBLE					OXIDIZERS		145.0	1.273	38

PROPERTIES

CLASSIFICATION	COMPOUND	INDUSTRIAL USE	WATER SOLUBILITIES (GR / 100 GR WATER)	TOXICOLOGY / HAZARDS	SURFACE TENSION	VAPOR PRESSURE (mm)	VAPOR DENSITY	SOLVENCY	REACTIVITY	VISCOSITY	BOILING POINT (C)	DENSITY @ 20 C	FLASH-POINT (C)
	2,3,4,5,- TETRAFLUOROACETOPHENONE			IRR \ COMB					OXID \ BASE		83.0	1.408	68
	2,3,4,5,6-PENTAFLUOROACETOPHENONE			COMBUSTIBLE					OXID\BASES		130.0	1.476	65
	3,3,4,4,5,5,6,6,6-NONAFLUORO-1-HEXENE			FLAMMABLE		0.5	8.5		OXIDIZERS		59.0	1.418	-17
	3,3,4,4,5,5,6,6,7,7,8,8,8-TRIDECAFLUORO-1-OCTENE			FLAM \ IRR					OXIDIZERS		270.0	1.520	19
	3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10-HEPTADECAFLUORO-1-DECENE			COMB \ IRR					OXIDIZERS		176.0	1.577	51
	DODECAFLUOROCYCLOHEXANE		SOLID						OXIDIZERS				NONE
	FLUORINERT-104		11.00	NO KNOWN	14	29			STABLE	0.8	101.0	1.770	229
	FLUORINERT-40		7.00	NO KNOWN	16	3			STABLE	2.2	155.0	1.870	270
	FLUORINERT-43		7.00	NO KNOWN	16	1.3			STABLE	2.6	174.0	1.680	294
	FLUORINERT-70		8.00	NO KNOWN	18	<0.1			STABLE	14	215.0	1.930	335
	FLUORINERT-71		9.00	NO KNOWN	18	<0.02			STABLE	<50	253.0	1.900	373
	FLUORINERT-72		10.00	NO KNOWN	12	232TORR			STABLE	0.4	56.0	1.680	178
	FLUORINERT-75		11.00	NO KNOWN	15	31			STABLE	0.8	102.0	1.770	227
	FLUORINERT-77		13.00	NO KNOWN	15	42			STABLE	0.8	97.0	1.780	226
	FLUORINERT-84		11.00	NO KNOWN	13	79			STABLE	0.55	80.0	1.730	205
	PERFLUOROHEPTANE			IRRITANT					STABLE		82.0	1.745	NONE
	PERFLUORO(METHYLDECALIN)			COMBUSTIBLE					OXIDIZERS		137.0	1.950	59
	PERFLUOROHEXANE			IRRITANT					OXIDIZERS		58.0	1.669	NONE
HETEROCYCLIC	1,2 - DIMETHYLNAPHTHALENE		INSOL					FATS \ OILS	OXIDIZERS		266.0	1.013	109
KETONES	2,4 - DIMETHYLCYCLOPENTANONE			COMBUST \ FLAM									
	2,4-DIFLUOROACETOPHENONE			IRRITANT					OXID \ BASE		152.0	0.895	41
	2-CYCLOHEPTEN-1-ONE								ACIDS \ BASES		81.0	1.234	66
	2-DECANONE								OXID \ BASE		90.0	0.988	68
	2-METHYL-1-TETRALONE						>1		OXID \ RED \ BASE		211.0	0.825	71
	2-METHYL-3-HEPTANONE			NA					OXIDIZERS		127.0	1.057	109
	2-NONANONE			COMB \ IRR					OXID \ BASE		158.0	0.816	43
	2-OCTANONE			IRRITANT					OXID/RED/BASES		192.0	0.832	64
	2-PENTANONE			COMBUSTIBLE					OXID/RED/BASE		173.0	0.819	62
	2-UNDECANONE		0.33	FLAMM \ IRR		27	3		STABLE		150.0	0.807	12
	3-HEPTANONE			COMBUSTIBLE		<1	5.9		OXID/BASE		231.0	0.825	88
	3-HEXANONE			COMB \ IRR		4.74	3.84		OXID \ RED/ BASE		146.0	0.818	41
	3-METHYL-2-CYCLOHEXEN-1-ONE		0.05	FLAMM \ IRR					OXID/RED/BASE		123.0	0.815	34
	[illegible]			COMBUSTIBLE							[illegible]	[illegible]	[illegible]
	3-NONANONE								OXID \ BASES		220.0	0.986	84
	3-NONEN-2-ONE			COMBUSTIBLE					OXID \ BASE		187.0	0.821	67
	3-OCTANONE			COMBUSTIBLE					OXID/BASE		85.0	0.848	81
	3-PENTANONE			COMB/IRR					OXID/RED/BASES		167.0	0.822	46
	4-HEPTANONE		5.00	COMBUSTIBLE		26.1	3		OXID/RED/BASES		192.0	0.816	12
	4-METHYLCYCLOHEXANONE			COMBUSTIBLE		5.2	3.93		OXID \ RED \ BASE		145.0	0.817	48
	5-METHYL-2-HEXANONE			COMBUSTIBLE					OXID/RED/BASE		169.0	0.914	40
	5-METHYL-5-HEXEN-2-ONE			COMB \ IRR		4.5	3.94		OXID \ RED \ BASE		145.0	0.838	41
	5-METHYL-5-HEPTEN-2-ONE			COMBUST \ HARM					OXIDIZERS		148.0	0.865	42
	6-UNDECANONE			COMBUSTIBLE					OXID/RED/BASE		73.0	0.855	50
	ACETONE			COMBUSTIBLE					OXID/RED		228.0	0.831	89
	ACETONYLACETONE					184	2		OXID \ RED		58.0	0.791	-17
	BENZYLACETONE								OXID/RED		191.0	0.973	78
	CYCLOBUTANONE								STABLE		235.0	0.989	98
	CYCLOBUTYL PHENYL KETONE								OXID \ RED		99.0	0.938	9
	CYCLODECANONE										118.0	1.050	109
	CYCLOHEPTANONE								OXIDIZERS		107.0	0.871	82
	CYCLONONANONE								COMB \ BASES		[illegible]	[illegible]	[illegible]
									OXID \ BASES		97.0	0.959	65

PROPERTIES

CLASSIFICATION	COMPOUND	INDUSTRIAL USE	WATER SOLUBILITIES (GR / 100 GR WATER)	TOXICOLOGY / HAZARDS	SURFACE TENSION	VAPOR PRESSURE (mm)	VAPOR DENSITY	SOLVENCY	REACTIVITY	VISCOSITY	BOILING POINT (C)	DENSITY @ 20 C	FLASH-POINT (C)
	CYCLOPROPYL 4-FLUOROPHENYL KETONE								OXIDIZERS		120.0	1.144	99
	CYCLOPROPYL PHENYL KETONE						5		OXIDIZED		123.0	1.056	90
	HEXAFLUOROACETYLACETONE								OXIDIZED		71.0	1.470	NONE
	METHYL ISOBUTYL KETONE		1.90	HARMFUL		15	3.5		STABLE		117.0	0.801	13
	OCTANOPHENONE			NA					OXIDIZERS		265.0	0.936	109
NAPHTHENES	CYCLOHEXANE			HARMFUL		77	2.9		OXIDIZERS		81.0	0.779	-17
(CYCLOALKANES	CYCLOPENTANE			HARMFUL		21.4	2		OXIDIZERS		50.0	0.751	1
	METHYLCYCLOHEXANE			FLAMMABLE		37	3.4		OXIDIZERS		101.0	0.770	-3
	1,2 - DIMETHYLCYCLOHEXANE			FLAMMABLE		31	3.5		OXIDIZERS		124.0	0.728	15
TERPENES	CITRONELLO			IRRITANT		0.02	5.4		OXIDIZERS		222.0	0.861	98
	ISOPRENE			TOXIC		33	2.35		V REACTIVE		34.0	0.681	18
	TERPINENE		INSOL	TOXIC		0.8	4.7		AIR		173.0	0.837	46
MISCELLANEOUS	WATER		INF	NONE	72	23.7				1	100.0	1.000	374
	PERCHLOROETHYLENE			TOXIC		13	5.83		BASES		121.0	1.623	NONE

EXHIBIT H

Whirlpool Information Network

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Edit

Type of Report: WIN Summary
Title: HOPE, 1996 - 1998
Authors: Database
Location: Research & Engineering
Product Category: Project Data
Technical Category: Notes Databases
Related Materials: Contains 137 documents from 1996-1998

Project Number:
Report Date: 03/01/1996

Report:
This db was for non-aqueous wash system development. Project leaders were Dan Conrad and Mark Kovich. Other team members included Earl Meister and Tre Wright.

Topics included chemicals tested, Cleaning potential of Triton GR-7M surfactant, Final Chemical Report for Project Athena, Experimental Results and Analysis of Displacement Fluids for Drying, Petroferm chemicals, and Oxiclear Gas Purifiers and Filters.

Team members can open the database with this link - Category View. It will ask you to authenticate with your userid and http/Domino password (REEP). If you do not have access to this database and would like more information, contact one of the names listed above or Gloria Begor at the Technical Information Center. From the Notes client this db can be found on ADCNSI in the directory/folder 'projects'.

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Not yet edited by anyone other than the Author

Project HOPE - Discussion Topic

C2C stage: Ideation **Project Number:**
Document Author: Daniel C Conrad **Date Composed:** 03/01/1996
Subject*: G.N.A.W. the majic "FuFu" dust
Category*: Presentations & Communications
Sub-Category: Intellectual Property **If other, indicate here:**
Text of Topic:
Presentation put together by Steve Krefman on the issues related to "Fu Fu" in the arena of General Non Aqueous Wash (GNAW)


FUFU.PPT

File Attachments (after viewing, use the **Back** arrow to return to this screen)
Attachment Types:

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Project HOPE - Discussion Topic

C2C stage: Ideation **Project Number:**
Document Author: Daniel C Conrad **Date Composed:** 03/07/1996
Subject*: FuFu Brainstroming Notes
Category*: Idcation History
Sub-Category: Brainstorm Notes **If other, indicate here:**
Text of Topic: Project HOPE initation brainstroming notes by Steve Krefman


FUFU.DOC

File Attachments (after viewing, use the **Back** arrow to return to this screen)
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Project HOPE - Discussion Topic

C2C stage: Ideation **Project Number:**
Document Author: Mark B. Kovich **Date Composed:** 05.06/1996
Subject*: Updated Non-Aqueous Matrix
Category*: Environmental Scan
Sub-Category: Chemistry **If other, indicate here:**
Text of Topic: This is the updated version of the matrix. I will cor tinue to update this as more information becomes available.


MATRIX.XLS

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Entered by Mark B. Kovich 06-May-96 at 09:35 AM

Project HOPE - Discussion Topic

C2C stage: Ideation **Project Number:**
Document Author: Catherine Tong **Date Composed:** 09/04/1996
Subject*: Detersive Properties of Hydrocarbons, Fluorocarbons, and Microemulsions
Category*: Test Results
Sub-Category: Testing **If other, indicate here:**
Text of Topic: This is report 517720-005.


TONG.DOC


RPT005.XLS

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Attachment Types: Word, Excel

Entered by Catherine Tong 04-Sep-96 at 10:13 AM

Report 517720-005

EXHIBIT I

49022-0026

CORPORATE TECHNOLOGY DEVELOPMENT
LAUNDRY APPLICATIONS
The Elisha Gray II
Research and Engineering Center
750 Monte Road
Benton Harbor, Michigan

TITLE: Detersive Properties of Hydrocarbons, Fluorocarbons, and Microemulsions

DATE: 15 August, 1996

PROJECT #: 517720-005

BY: Catherine Tong
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Technical Information Center

Summary

The purpose of this investigation is to discover a water replacement as well as a cleaning agent that can be used in a non-aqueous wash process. Table 1 displays a list of the variety of fluids from different chemical families that were tested. These include alcohols, carboxylic acids, esters, fluorocarbons, ketones, terpenes, and microemulsions. The fluids were evaluated based on the wash performance on selected swatches. A matrix of the fluids and the observations from each test can be found in Table 2. Figures 2-4 show the wash performance of the various fluids. The numerical results of the tests can be found in Tables 3-4.

From the observations and testing generated so far, the fluorinated compounds are likely candidates for a water replacement. However, the compounds have demonstrated inferior detersive performance to Tide. Neat solutions which are ones that are only composed of one chemical compound are not necessarily the way to go. Because of the complexity of different types of stains and soils a cosolvent or multicomponent mixture containing an inert working fluid will most likely be needed in the non-aqueous cleaning process to achieve all fabric care.

Background

Environmental and health concerns have increased regarding chlorinated solvents such as perchloroethylene, trichloroethylene, methylene chloride, and 1,1,1-trichloroethane. In 1987, the *Montreal Protocol on Substances That Deplete the Ozone Layer* was signed to protect the stratospheric ozone layer. The treaty specifies that the production and consumption of chlorofluorocarbons, halons, and carbon tetrachloride are to be phased out by the year 2000. Scientific evidence suggests that these compounds deplete the ozone layer that shields the planet from damaging UV-B radiation. Therefore, new non-ozone depleting, nontoxic, and low global warming potential cleaning agents that work as well as the chlorinated solvents if not better have been the focus of research in the cleaning industry.

In the dry cleaning industry, perchloroethylene is used as the preferred solvent for delicate fabrics. Research has been centered on finding better recovery systems for this fluid so that it doesn't leak into the atmosphere as well as searching for alternative chemistries that can be used in the dry cleaning system. For example, prototype CO_2 dry-cleaning processes have been documented. New solvents that are discovered for washing garments could also be used in wash systems for the home.

The ultimate goal of the non-aqueous wash project is the "perfect care of all fabrics requiring no time and effort." Therefore, many different types of fabrics were used in the testing of the detersive properties of the fluids. The swatches used include AS-9 Cotton, PC-9 Blend, Clay, Wool, Silk, Nylon, and Rayon. Most of the testing was done on the AS-9 Cotton since only a limited amount of certain fluids was available. AS-9

is a cotton swatch that is soiled with pigment oil. PC-9 is a polyester/cotton blend that is also soiled with pigment oil. The Clay is a cotton swatch that is soiled with a bandy black research clay. The Wool, Silk, Nylon, and Rayon are swatches that are soiled with dust sebum. Testing the detersive properties of the fluids on these various swatches will help evaluate the vision of the non-aqueous wash project. However, the remaining portion of the report will focus mostly on differences seen using AS-9.

The purpose of this investigation is to identify chemistries that can be used in the non-aqueous wash process for home use. The non-aqueous wash process is washing without water Water can cause swelling of the fibers within the fabric and damage the garment. The discovery of a water replacement as well as a cleaning agent is the focus of the investigation. A variety of fluids from different chemical families were tested. These include alcohols, carboxylic acids, esters, fluorocarbons, ketones, terpenes, and microemulsions. These fluids were picked based on safety reasons as well as on information obtained from scientific literature. Most of the fluids have a relatively high flash point which is the lowest temperature at which vapors above a volatile combustible substance ignite in air when exposed to flame. Some of the fluids like the hydrofluoroethers have already been used in the metal cleaning industry. Compounds with a low vapor pressure, low viscosity, or a low surface tension were also considered. Benefits of these characteristics are as follow; a low vapor pressure fluid dries quickly. A low viscosity and a low surface tension fluid can speed up the wetting of the fabric during the wash process and may promote particulate soil removal. A list of the various compounds along with the chemical families to which they belong is in Table 1.

Test Setup

In this test, there were basically two methods used to find the detersive properties of the fluids. The first test involved using a tergotometer which models a washing machine. The tergotometer has a vertical axis that twists clockwise and counterclockwise and was set to agitate at 100 spins per minute. The containers of the tergotometer were sealed by screws around the perimeter of the cover, and reflux condensers were placed in a hole on the cover to condense any vapors from the fluids. Five swatches were agitated in one liter of fluid in the machine for five minutes.

The second test was done in beakers. Some of the fluids could only be ordered in quantities smaller than the volume of the tergotometer. Since this was the case, some fluids were tested in beakers with swatches washed one at a time under a fume hood. The swatches were stirred in the beakers in a way similar to the rotation of the tergotometer axis for five minutes. The detailed procedure of the test method is located in Figure 1.

Results

All results are reported in Delta Y values and are compared to the baseline value obtained from testing with Tide. As a rule of thumb, a Delta Y value of three or greater can usually be visible. Besides washability, other observations include drying times, odors, and fabric damage as noted. A matrix of the fluids and the observations from each test can be found in Table 2. The numerical results of the tests can be found in Tables 3-4.

Washability

Fluorinert was the only compound besides Tide that was tested with all seven types of swatches. It is a fluorinated compound produced by 3M. Fluorinert performs inferior to Tide. Figure 2 compares these two fluids in their washing capabilities.

Most of the testing was done on the AS-9 Cotton swatches since most fluids were not available in substantial amounts. Figure 3 shows the Delta Y values of the tergotometer test with the fluids grouped according to their respective chemical families. With this method, the fluids that performed the closest to Tide were the Inverts. Inverts are microemulsions developed by Dow that are 50% water and 50% solvents and surfactants. All other fluids tested with this method did not perform up to Tide's standards. The alcohol, ether, ketones, one of the carboxylic acids, and one of the fluorinated compounds performed similar in their Delta Y values to each other. Triton X-100 caused a negative Delta Y value. This might be due to residues or splotches left on the swatch after a significantly long drying period.

Due to insufficient volumes of fluid, a beaker test was used to evaluate AS 9 swatches. Of the fluids tested in this manner, only Tarksol, an aqueous degreaser from Terpene Technologies, with a water rinse performed similar to Tide. All other fluids tested performed inferior to Tide. The terpenes had varying ability to clean fabrics. The fluorinated compounds performed inferior to the esters, terpenes, and one of the carboxylic acids. The other carboxylic acid, diethyl dodecanedioate, resulted in a negative Delta Y value. Again, this might be due to residues or splotches left on the swatch. Perhaps a solvent rinse or increased temperatures would speed up the drying process and not leave residues on the swatches. The results are shown in Figure 4.

Drying Times

Drying times are also an important observation from these tests. The swatches were mostly hung dry in the fume hood with the exception of the Tide and Fluorinert which were laid flat to dry. Quick drying times can mean faster laundry cycle times for the consumer as well as less energy used. The ability to dry quickly can somewhat be attributed to a physical property of the fluid called vapor pressure. A fluid with a low vapor pressure has the ability to evaporate quickly and efficiently, causing the fabric to dry almost immediately after the wash. The compounds with this property are the fluorocarbons. Some other fluids

like 2-pentanone and a-terpinene dry relatively quickly as well when compared to water. The remaining fluids require drying times from two hours to two days. Figure 5 shows a spectrum of these drying times.

Fabric Damage

Because any damage to the garment cause by washing with solvents would not be beneficial to the consumer, a preliminary fabric damage assessment is necessary. Indications of fabric damage include fraying at the edges of the swatch and no retainment of the texture of the fabric. With respect to the swatches washed in Fluorinert, there doesn't appear to be any fabric damage, not even to wool. Tide caused substantial fraying of the wool swatches. As to the AS-9 cotton swatches, none of them seem to be damaged from a visual inspection.

Odors

Many of the fluids have different odors associated with them. The various smells might have to be masked by perfumes or other agents during the wash process. One group without any odors are the fluorocarbons. Most of the fluids emit bad odors, but some of them exhibit a fruity smell. These include the terpenes such as the Inverts and the Invert Detergents, which are produced from natural products like citrus and pine oils,.

Conclusion

From the observations and testing generated so far, the fluorinated compounds are likely candidates for a water replacement. They can be considered good inert working fluids which are ones that show little or no detersive properties and do not cause swelling of the fibers in the fabric. They are non-reactive with any chemicals or with the garment. With the limited number of tests performed, the compounds have demonstrated inferior detersive performance to Tide. Neat solutions which are ones that are only composed of one chemical compound are not necessarily the way to go. Because of the complexity of different types of stains and soils, a cosolvent or multicomponent mixture containing an inert working fluid will most likely be needed in the non-aqueous cleaning process to achieve all fabric care.

There are many other experiments that are needed to fully evaluate a fluid for use in the non-aqueous wash process. Some further testing such as surface tension, dimensional stability of the swatch, and the solvency of the fluid can provide more insight into the potential for a home non-aqueous wash system.

Figure 1

Test Methods

Detersive Evaluation. Two types of tests were used in determining the detersive properties of the fluids. Test I was done in the tergotometer while Test II was done in beakers. The swatches used include AS-9 Cotton, PC-9 Blend, Clay, Wool, Silk, Nylon, Rayon, and CS-4 Oily.

Tergotometer Test (for Tide)

1. Read 5 swatches of one type on the colorimeter.
2. Add 1L of water at a given temperature and 4 ml of Tide into a tergotometer container.
3. Place the 5 swatches into the container.
4. Agitate for 5 minutes at 100 spm.
5. Rinse the swatches in 70°F water for 5 minutes.
6. Remove the swatches and air dry.
7. Read swatches on the colorimeter.
8. Repeat the procedure 2 more times at the given temperature.
9. Repeat the procedure at three temperatures: 70°F, 100°F, and 140°F

Tergotometer Test (for other non-aqueous fluids)

1. Read 5 swatches of one type on the colorimeter.
2. Add 1L of fluid into a tergotometer container.
3. Place the 5 swatches into the container.
4. Agitate for 5 minutes at 100 spm and at 70°F.
5. Remove the swatches and hang dry in the fume hood.
6. Read swatches on the colorimeter.
7. Repeat the procedure 2 more times if enough fluid.

Beaker Test

1. Read 5 swatches of one type on the colorimeter.
2. Add 50 ml of fluid into a beaker.
3. Place 1 swatch into the beaker.
4. Stir with a stirring rod for 5 minutes.
5. Remove the swatch and hang dry in the fume hood.
6. Repeat the procedure 4 more times.
7. Read the swatches on the colorimeter.